

# A METHOD FOR INDICATING ECONOMIC TRANSITION WITH AN APPLICATION TO ALBANIA

**C. Paul Hallwood**

*University of Connecticut*

and

**Ronald MacDonald**

*University of Strathclyde*

This paper offers a method for assessing progress towards a market economy in transitional economies and applies that method to a largely overlooked economy, Albania, in the early stages of its economic reform following the fall of communism in 1992. The macroeconomic model outlined below allows for an increase in the role of relative prices, a major feature of transitional economic policies designed to promote efficient resource allocation. Specifically, we introduce relative prices in the form of the real exchange rate, which, apart from affecting a country's international competitiveness, measures the ratio of prices of nontraded goods to traded goods. As such, the real exchange rate affects very broad classes of goods, and is an important relative price in a transitional economy opening itself to the world economy.

A feature of our approach, which we exploit in our econometric modeling, is the interdependence of macroeconomic and relative price (or real exchange rate) equilibrium. Thus, the equilibrium real exchange rate is determined by the equilibrium relative prices of traded and nontraded goods in microeconomic equilibrium as well as by simultaneous internal and external balance in macroeconomic equilibrium. This is contrary to the strictly internal-external balance models of, for example, Allen and Stein [1995], Corden and Neary [1982], and Dornbusch [1973]. In fact, it is possible for an economy to be in macroeconomic equilibrium—operating at full employment with stable prices—while the level of the real exchange rate is more or less indeterminate. This would be the case in a centrally-planned economy, which was, in effect, ignoring relative price signals in resource allocation, or, in a transition economy where relative prices were yet to play a major role in resource allocation. However, as relative prices become incrementally more important in the allocation of resources, it becomes possible to talk about the “set of equilibrium relative prices”—which we proxy with the *equilibrium* real exchange rate.

What is important about this is that the equilibrium real exchange rate creates a “center of gravity” to which we expect the observed real exchange rate to gravitate. In a statistical sense, therefore, we expect that when relative prices have become important in a country's resource allocation, the real exchange rate will be mean-reverting.

---

**C. Paul Hallwood:** University of Connecticut, 31 Sterling City Rd, Lyme, CT 06371. E-mail: Hallwood@uconnvm.uconn.edu

*Eastern Economic Journal*, Vol. 28, No. 4, Fall 2002

But when relative prices are not yet much involved in resource allocation—as when reform policies have been inadequately applied—the real exchange rate need not be mean-reverting; indeed, it may follow a random walk. The assertion that relative prices, as measured by the real exchange rate, should be mean-reverting is nothing more than a statistical statement of a fundamental theorem in economics: if markets are “working” then prices will tend towards the equilibrium. An advantage of using Albania as a case study is that transitional economic policies were from the outset introduced unusually quickly [Clunies-Ross and Sudar, 1998], so that price signals were perhaps less confounded by vestiges of central planning than in some other transition economies.

Two problems could confound a statistical test of mean reversion of the real exchange rate. First, even when transition to a market economy has progressed quite far—that is, when relative prices are playing an increasingly important role in the transitional economy—the level of the equilibrium real exchange rate may itself be subjected to a series of shocks, so that mean reversion is not observed. However, neither shocks nor strongly statistically significant trends in the equilibrium real exchange rates of several Eastern European countries during the early stages of their transition were found by Begg, Halpern and Wyplosz [1999], Halpern and Wyplosz [1997], or Krajnyak and Zettelmayer [1998]. Secondly, macroeconomic stabilization policies may interfere with transition policies, temporarily preventing the observed real exchange rate from moving toward its equilibrium value. For example, inflationary monetary policy may so affect the *nominal* exchange rate that it is monetary policy, and not transitional structural policies, that drives the observed real exchange rate. For this reason we have estimated a monetary model of the lek’s nominal exchange rate and find that monetary policy, more specifically the monetary-fiscal policy mix, in our data set was in fact well-behaved in Albania. This probably explains why in our data, according to the coefficient of determination, variation in the nominal exchange rate explains only about 37 percent of variation in the real exchange rate. Thus, the nominal exchange rate is by no means the only factor driving the real exchange rate, leaving for room for it to be also influenced as we hypothesize.

Our examination of Albania’s real exchange rate, shown in Figure 1, continues as follows: we offer some stylized facts about the Albanian economy, followed by an outline of our macroeconomic relative-price model. We continue by discussing the determinants of the *real* exchange rate over successive stages of transition. We then discuss how we investigate the behavior of the lek’s *nominal* exchange, and follow with a description of data sources. After a brief discussion of econometric methods we present tests for the stationarity of our real exchange rate time series followed by our results from estimating a monetary model of the nominal exchange rate.

## ALBANIA’S EARLY ECONOMIC TRANSITION—SOME BACKGROUND

Politically, the rise to power of the non-communist Democratic Party of Albania during the general election of March 1992 was a watershed event in Albania. At this time, economic policy veered from acute central planning towards important market-oriented reforms.<sup>1</sup> Following severe declines in GDP from 1990 to 1992, high inflation

**FIGURE 1**  
**The Real Value of the Albanian Lek-U.S. Dollar Exchange Rate**

in 1991 and 1992, and enormous fiscal and balance-of-payments deficits beginning in 1990 [IMF, May 1994], comprehensive price and trade-system reforms were quickly introduced. Also, new fiscal and monetary measures were aimed at stabilizing the macroeconomic economy. A “central role was assigned from the outset to price, exchange and trade liberalization” [IMF, May 1994, 158]. Structural reforms were to be phased in over several years covering, privatization of farmland and most public enterprises, as well as financial sector reform. Very quickly the small retail and service sectors were almost completely privatized; the construction sector was extensively privatized. Large industrial units remained publicly owned, but became subject to a harder budget constraint than formerly.

In October 1994 the IMF commented that “Albania had been successfully implementing a comprehensive economic adjustment effort since mid-1992” and “program policies have been implemented broadly as intended” [October 1994, 329]. That is, privatization objectives had been largely achieved, “sweeping price liberalization measures” had been implemented and foreign trade and foreign currency systems had been liberalized. Furthermore, under the terms of the IMF’s second Enhanced Structural Adjustment Facility loan of September 1994, Albania was expected to proceed with further structural reform of the large public enterprises and the banking system, as well as to create a legal framework for a private enterprise economy.

According to the European Bank for Reconstruction and Development (EBRD) [Aoki and Kim, 1995], by 1994 Albania had moved 50 percent of its GDP production onto a private-sector basis—more than Bulgaria, Moldova or Romania, and only slightly less than the acknowledged reform-minded Hungary. Also according to the EBRD, Albania had achieved “market economy” status in trade and foreign exchange reform, and these reforms had progressed more than in any other sectors.

Typical of other eastern and central European transition economies, reform of Albania's nontraded goods sector (for example, public utilities) lagged its traded goods sector. There were various reasons for this: everything could not be done at once, IMF conditionality favored reform of other sectors first, and retention of the public utilities in public ownership could be used to cushion the harshness of market reforms which were expected to increase sharply the rate of unemployment.

Yet even with economic reform underway, market-failures abounded. For example, restructuring of companies to give efficient corporate governance had hardly progressed. Similarly, little progress had been made in shaping banks into efficient financial intermediaries. From 1993 Albanian companies increasingly used pyramid borrowing schemes to raise funds. In essence, companies attracted funds by paying very high rates of interest—10 percent per month and more, and were able to do so only by attracting ever more depositors. Even if the fraudulent element of pyramid borrowing is overlooked (that is, depositors' savings were simply stolen) its existence is a symptom of severe problems with the system of financial intermediation in Albania. Banks are supposed to be the specialist financial intermediaries that reduce adverse selection and moral hazard risks. Absent an efficient banking system and other means of reducing adverse selection and moral hazard, such as disclosure laws, financial intermediation is almost bound to be inefficient. Thus, the widespread use of pyramid schemes in Albania reflected a structural weakness. This was a weakness that had bitter political implications. The breakdown of the pyramid schemes led to rioting and the severe disruption of legal order in 1997. Exactly which date marks the end of Albania's early transition is difficult to determine. It was certainly possible to say that progress had halted sometime in 1997. But we have chosen an earlier date, summer 1996, when milder signs of social breakdown under the strains of transition were already becoming apparent.

## MACROECONOMIC BALANCE

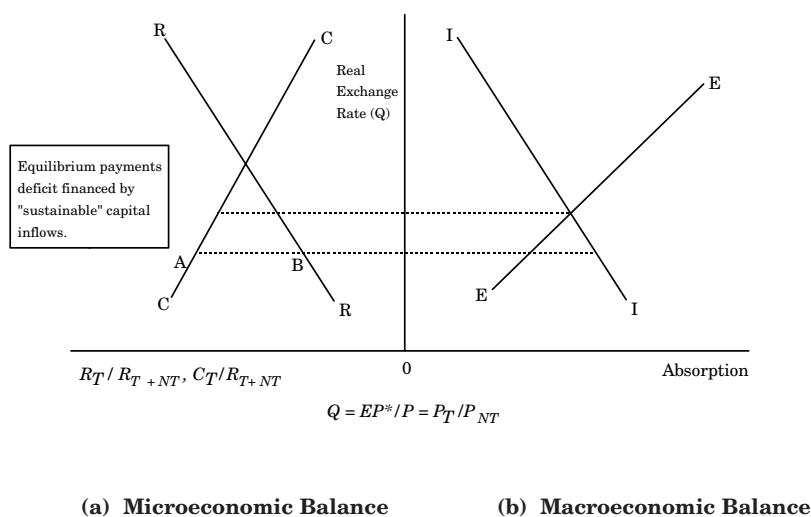
Macroeconomic balance results when goods, labor, and foreign exchange markets are in equilibrium. Thus, internal balance occurs when unemployment is at its natural, or, equilibrium, rate. At the corresponding level of equilibrium real GDP, the equilibrium real exchange rate is

$$(1) \quad Q = Q(A, U) \quad Q_A < 0, Q_U < 0,$$

where  $Q = EP^*/P$ ,  $E$  is the amount of domestic currency per unit of foreign exchange,  $P$  the price level in the home country,  $P^*$  the price level in the rest of the world (proxied in our empirical application by that of the United States)<sup>2</sup>,  $A$  is domestic absorption (that is, real GDP plus exports), and  $U$  is the equilibrium rate of unemployment.

The equilibrium rate of unemployment is endogenous to the transition process. It is affected by changes in enterprise labor-hoarding policies as firms are privatized, the economic usefulness of the extant capital stock changes and the social security system changes. The condition  $Q_A < 0$  is required to keep the level of spending (domestic plus foreign) on domestic product steady at the full employment level. An

**FIGURE 2**  
**Microeconomic and Macroeconomic Balance**



appropriate appreciation of  $Q$  will switch foreign demand away from “home’s” goods just as domestic absorption is increasing. In Figure 2(b),  $II$  is the internal balance function.  $Q_U < 0$  because a rise in the equilibrium rate of unemployment requires demand to be switched away from domestic goods. A rise in the equilibrium unemployment rate shifts  $II$  to the left.

For external balance the level of  $Q$  must yield a sustainable trade balance where, following Williamson [1994], “sustainability” depends on the level of “sustainable” capital inflow. Thus,

$$(2) \quad Q = q(A, K, X, J, B) \quad q_A > 0, q_K < 0, q_X < 0, q_J < 0, q_B > 0.$$

Here  $q_A > 0$  is necessary as higher absorption increases import demand.<sup>4</sup> The shift factors governing the external balance function,  $EE$ , in Figure 2(b), all of them potentially endogenous to the transition process, are  $K$ , the level of “sustainable” international capital inflow,  $X$ , the level of net exports exogenous to  $Q$  (depending, for example, on the modernization of a transition economy’s traded goods sector),  $J$ , the level of tariffs and other impediments (such as licenses and quotas) to imports, and  $B$ , the level of subsidies on nontraded goods production.

## RELATIVE PRICES OF TRADED AND NONTRADED GOODS

The real exchange rate is also the relative price of nontraded to traded goods. That is,  $Q = P_T / P_{NT}$ , where  $P_{NT}$  is the price of nontraded goods and  $P_T$  the price of traded goods).<sup>4</sup> A more complete analysis of the behavior of the real exchange rate

under economic liberalization should combine this resource allocation aspect of internal-external balance with the macroeconomic aspect already considered.

The RR function in Figure 2(a) is the share of traded goods in domestic production,  $R_T/R_{NT+T}$ , where domestic production is the sum of nontraded and traded goods produced. This share declines as the real exchange rate appreciates because a lower  $Q$  squeezes profits in the traded goods sector relative to those in the nontraded sector. CC is the ratio of traded goods in domestic consumption to domestic production ( $C_T/R_{NT+T}$ ), and it is a decreasing function of the real exchange rate because real appreciation reduces the relative price of traded goods.  $Q_1$  is the equilibrium real exchange rate because the “sustainable” capital inflow finances the current account deficit. At a more appreciated (that is, lower) real exchange rate, such as at the level marked A-B,<sup>5</sup> there is an unsustainable current account deficit that will have to be adjusted.

The slope of RR depends on the elasticity of resource substitution between traded and nontraded goods with respect to a change in  $Q$ : a relatively flat slope indicates a high degree of substitution. Similarly, a high degree of elasticity of substitution in consumption will render the CC function relatively flat.

Thus, we can write

$$(3) \quad C_T/R_{NT+T} = f(Q) \quad f' < 0$$

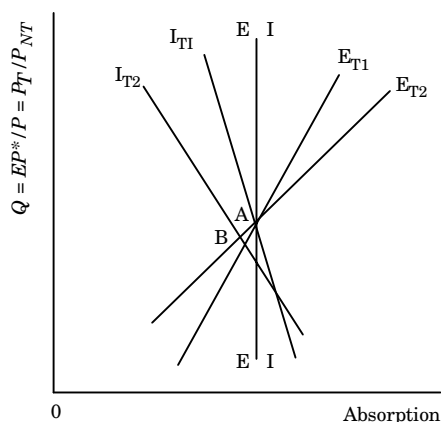
$$(4) \quad R_T/R_{NT+T} = g(Q) \quad g' > 0$$

Differentiating excess demand for traded goods,  $f(Q) - g(Q)$ , with respect to  $Q$  shows that excess demand is a negative function of  $Q$ . Excess demand will be greater the larger are  $f$  and  $g$  in absolute value. To maintain external balance on EE, as  $Q$  appreciates, domestic absorption must fall to reduce  $C_T$  relative to  $R_T$ . Similarly, with the function II, the more sensitive are CC and RR to a change in  $Q$ , the flatter is II because a given appreciation of  $Q$  causes a larger trade deficit which needs to be offset by an increase in absorption to maintain internal balance.

We hypothesize that the steeper are the functions in Figures 2(a) and 2(b), the smaller is the disequilibrium at any actual  $Q$  and the weaker will be the forces driving  $Q$  towards its equilibrium level. From the microeconomic side, if much of resource allocation remains outside of the price system so that in the economy as a whole the elasticity of substitution in production remains low, excess supply will be corrected only slowly because the state still controls (for example, through the soft budget constraint) a large part of the economy. From the macroeconomic side, even if the actual  $Q$  diverges greatly from its equilibrium level, given a pair of steep EE and II functions, neither external nor internal disequilibrium need be large. A small external disequilibrium may be easily financed through, for example, foreign short-term borrowing. And an internal disequilibrium may persist as the government sterilizes real balance effects that are themselves not necessarily large.

To summarize, as resource allocation and the pattern of consumption become more responsive to price signals, the slopes of RR, CC, II and EE will become flatter, with important implications for the time-series behavior of the real exchange rate. Thus, if structural reforms in a transitional economy are succeeding in making rela-

**FIGURE 3**  
**Transitional Fanning of II and EE Functions**



tive prices more effective in the resource allocation process, we expect to see that the observed real exchange rate is mean reverting. This would be due to relative prices seeking their equilibrium level.

### THE OPENING OF A FAN

Under central planning there were high levels of administered prices and of state ownership of enterprises. With stylized “complete” central planning because relative prices did not much affect resource allocation, II and EE in Figure 3 are vertical—at a level of absorption which guaranteed very low levels of unemployment. By default, a centrally-planned economy must have had some real exchange rate, but it played no role in resource allocation. Changes in the ratio of domestic to world prices for a given nominal exchange rate would change  $Q$ , but the central planners had several tools to prevent this from affecting resource allocation. These included the variable import tariff (which was set to ensure that imported goods did not cost less than substitute home-produced goods), import quotas and licenses, export taxes, and if these somehow failed, production quotas, and variable production subsidies.

The effect of sequenced transition in  $Q$ - $A$  space is shown in Figure 3 by EE gaining a positive slope and II a negative slope. While the transition process may more closely approximate a continuum, we will divide it into two stages because this is more easily reproduced in our figure. We are not asserting that there are only two stages, only that we will refer to the first two. Thus,  $II_{T1}$  and  $EE_{T1}$  indicate the first transitional stage when resource allocation through the market has begun to affect only one or a few sectors, very probably parts of the traded good sector, newly opened up to international competition. The respective slope coefficients appear because resource allocation has begun to respond to price signals. Thus, on the  $II_{T1}$  function, internal balance can be maintained when a decline in autonomous domestic absorption can be balanced by a depreciation of the real exchange rate that increases net



exports, and production in the traded goods sector. But, the  $EE_{T1}$  and  $II_{T1}$  functions are still rather steep because many sectors remain insensitive to relative prices, and will not readily give up resources. Furthermore, as Sundakov, Ossowski and Lane [1994] have noted, resource allocation even in a liberalized traded goods sector may well remain tangled in the web of residual central planning. And, as explained earlier, the equilibrium rate of unemployment almost certainly increases as structural adjustment increases ( $II_{T1}$  shifts leftward).

In the second transitional stage more sectors are reformed including parts of the non-traded goods sector. The withdrawal of variable subsidies and the introduction of the hard budget constraint to enterprises in this sector will render them more responsive to price signals. As a result,  $II_{T2}$  is flatter than  $II_{T1}$ , and  $EE_{T2}$  than  $EE_{T1}$ , and so on through the transition. The elasticity of substitution in production and consumption increases as progress towards a market economy continues. As a result, the *equilibrium* real exchange rate becomes a progressively stronger attraction for the *actual* real exchange rate, and so we expect the tendency for mean reversion to increase.

### NOMINAL EXCHANGE RATE BEHAVIOR DURING THE TRANSITION

The behavior of macroeconomic policy also needs to be investigated because, as we have said, this too can affect the equilibrium real exchange rate. Principally this influence would be through its effect on the behavior of the *nominal* exchange. Thus, it is possible that excessive volatility in the nominal exchange rate, rather than the other factors mentioned above, could dominate the behavior of the real exchange rate. For this reason, the behavior of the nominal exchange rate needs to be investigated, and to do this we estimate the following monetary model [MacDonald, 1995] using the Albanian lek. That is, we estimate

$$(5) \quad e_t = \alpha(m_t - m_t^*) + \beta(y_t - y_t^*) + \gamma(i_t - i_t^*) + \varphi_t,$$

where  $e$  denotes the logarithm of the nominal exchange rate,  $m$  denotes the logarithm of the money supply,  $y$  denotes the logarithm of real income,  $i$  denotes the interest rate (expressed as a percentage) and  $\varphi$  denotes a disturbance. Equation (5) simply states that the nominal exchange rate is driven by the relative excess of the supply of money over demand, as given by the income and interest rate terms. Given the interpretations of  $\beta$  and  $\gamma$  as an income elasticity and an interest rate semi-elasticity, respectively, they should take on values close to the estimated values in money demand functions (that is,  $\beta$  is expected to be between  $-0.5$  and  $-1$ , while  $\gamma$  may take on a value between  $0.002$  to  $0.02$ ). A value of  $\alpha$  above unity would indicate exchange rate “overshooting,” while a value less than unity would represent “undershooting.” Overshooting could be due to lack of a credible monetary policy by holders of the domestic money supply. Thus, an increase in the money supply in period  $t$  could be taken as signaling higher monetary growth in the future so that there is a “magnification” effect from the current percentage change in the money stock to the current exchange rate.<sup>6</sup> However, undershooting could indicate confidence that current shocks to the



money supply will be reversed by the authorities so that faith in the currency remains high: asset-holders preferring to go on holding it rather than diversifying into real or foreign assets. Thus, undershooting is a vote of confidence in the authorities.

Since nominal exchange rate volatility, as well as mean reversion in the real exchange rate, may indicate the extent of economic progress being made in a transitional economy we estimate equation (5) below.

## DATA SOURCES

The real exchange rate is constructed using the home currency price of one unit of foreign currency definition (that is,  $Q = EP^*/P$ ). We have chosen the U.S. dollar as the foreign currency for three reasons. First, at least through our data period, 1992-1996, a widespread U.S. dollar parallel currency market existed in Albania. Second, after the lek was floated in July 1992, the central bank used monetary policy to target the lek at about 100 per U.S. dollar, and, third, Albanian banks did their foreign exchange accounting in dollars [Clunies-Ross and Sudar, 1998].

Our price and exchange rate data are taken from the IMF's International Financial Statistics CD-ROM June 1996 issue. The nominal exchange rate is line *ae* and the Albanian and U.S. price series are the consumer price index, line 64. The sample period for the real exchange rate is July 1992 to April 1996. As noted above, we also propose testing a monetary approach equation. The Albanian money supply (narrow money) and interest rate series were both obtained from the Central Bank of Albania, while the output figures are from the Albanian statistical office. The corresponding U.S. data have been extracted from the IMF CD-ROM disc. All variables, apart from the interest rates, have been transformed into natural logarithms.

## THE TIME SERIES PROPERTIES OF THE REAL EXCHANGE RATE

In testing the mean-reverting properties of the lek real exchange rate, we start with a standard Dickey-Fuller unit root test. Although it is now widely accepted (see for example Campbell and Perron [1991] for an overview of the unit root literature) that such a test has relatively low power to discriminate between a series which has exactly a unit root and one which is highly autoregressive, but nonetheless mean-reverting (that is, has a root close to the unit circle), it will nevertheless prove a useful starting point for our empirical examination.

Assume that the log of the real exchange rate,  $q_t$ , has the following ARMA specification:

$$(6) \quad \phi(B)q_t = \alpha + \theta(B)\epsilon_t,$$

where  $B$  denotes the lag operator and  $\alpha = \varphi_0 = \varphi_1 t$  where  $t$  is a deterministic time trend. The easiest way to motivate a test for a unit root in  $q_t$  is to assume that it has a purely autoregressive representation which will be the case if the moving average polynomial,  $\theta(B)$ , in equation (6) is invertible. Given this assumption we may reparameterize equation (6) as:

$$(7) \quad \Delta q_t = \gamma_o + \gamma_I t + (\beta_o - 1)q_{t-1} + \sum_{j=1}^{n-1} \beta_{j+1} \Delta q_{t-j} + v_t,$$

where

$$(8) \quad \beta_i = \sum_{j=1}^n \phi_j; \quad i = 1, \dots, n,$$

since  $\varphi(B)$  will contain a unit root if,  $\sum_{j=1}^n \phi_j = 1$  the presence of a unit root is formally equivalent to a test of whether  $\beta_0 = 1$  or  $(\beta_0 - 1) = 0$ . This hypothesis may be tested using a standard  $t$ -test, although as Dickey and Fuller [1979] and many others note this will have a non-standard distribution and therefore one has to use the percentiles tabulated by Fuller [1976]. One may test for two unit roots in the real exchange rate by estimating equation (6) with all of the  $q_t$  terms first differenced again. Including the correct specification of deterministic variables in equation (6) is crucial to the power of the test [Campbell and Perron, 1991].

Five different lag-length selection criteria have been used to estimate equation (6): the Akaike Information Criterion (AIC), the Bernanke Information Criterion (BIC), the Ljung-Box test (Lj-Bo), a Lagrange multiplier statistic (LM), and a reduction statistic (Red). The first two tests, and the last, all take 12 lags as their starting point and work down from this general lag structure to a parsimonious equation. Criteria Lj-Bo and LM take a zero lag as their starting point and work up to a more general lag structure (if appropriate) on that basis.

The results from estimating equation (6) for the real lek exchange rate are presented in Table 1. For the full sample period, 1992:8 to 1996:4, we note that on the basis of two criteria, the Lj-Bo and LM tests, that the null of a unit root is convincingly rejected. Since only these two criteria also indicate stationarity when the series are first differenced, while the remaining three do not, we believe them to be the most reliable in the current context (the others have, given the relatively small sample size, probably overfitted the data). In case the results are contaminated by the inclusion of the first observation, which acts as a huge outlier (see Figure 1), we have also computed these statistics excluding the first observation. These results, reported in the bottom half of Table 1, are essentially the same as the results reported in the top half.

As an alternative way of checking the time series properties of our chosen real exchange rates we also constructed variance ratio statistics. Lo and MacKinlay [1988], for example, have demonstrated that the variance ratio test has greater power to reject the null hypothesis of a unit root, when it is false, than the standard Dickey-Fuller test, essentially because it is better able to capture the underlying time series properties of the data. The variance ratio test was introduced into the recent economics literature by Cochrane [1988] and has the further advantage of offering a very straightforward interpretation of how rapidly a series reverts back to, or diverges from, its mean value.

The variance ratio test is constructed as:

**TABLE 1**  
**Four Unit Root Tests for the Albanian Real Exchange Rate**

**Unit Root Tests for Albanian Exchange Rate 1992: 7 - 1996: 4**

Variable	Sample	Test	Lags	No Trend		Test	Lags	Trend		t-Statistic on Trend Term
				ADF	5%			ADF	5%	
Real ER (Consumer Prices)	1992: 7 to 1996: 4	AIC	6	-2.0951	-2.93	AIC	6	-0.0110	-3.50	1.1574
		BIC	1	-2.5911	-2.93	BIC	1	-0.8155	-3.50	0.4164
	1996: 4	Lj-Bo	0	-5.7548	-2.93	Lj-Bo	2	-1.0247	-3.50	0.2481
		LM	0	-5.7548	-2.93	LM	1	-0.8155	-3.50	0.4164
		Red	4	-2.7572	-2.93	Red	10	-0.2356	-3.50	1.8330

**Unit Root Tests for First Difference in Albanian Exchange Rates 1992(7) - 1996(4)**

Variable	Sample	Test	Lags	No Trend		Test	Lags	Trend		t-Statistic on Trend Term
				ADF	5%			ADF	5%	
Real ER (Consumer Prices)	1992: 8 to 1996: 4	AIC	5	-2.5787	-2.93	AIC	5	-3.6948	-3.50	2.4433
		BIC	5	-2.5787	-2.93	BIC	5	-3.6948	-3.50	2.4433
	1996: 4	Lj-Bo	0	-15.191	-2.93	Lj-Bo	1	-4.3447	-3.50	1.3970
		LM	0	-15.191	-2.93	LM	0	-15.885	-3.50	2.4773
		Red	10	-0.0523	-2.93	Red	9	-3.7201	-3.50	3.8939

**Unit Root Tests for Albanian Exchange Rate 1992(8) - 1996(4)**

Variable	Sample	Test	Lags	No Trend		Test	Lags	Trend		t-Statistic on Trend Term
				ADF	5%			ADF	5%	
Real ER (Consumer Prices)	1992: 8 to 1996: 4	AIC	6	-2.0951	-2.93	AIC	6	-0.0110	-3.50	1.1574
		BIC	1	-2.5911	-2.93	BIC	1	-0.8155	-3.50	0.4164
	1996: 4	Lj-Bo	0	-5.7548	-2.93	Lj-Bo	0	-6.4330	-3.50	3.5885
		LM	0	-5.7548	-2.93	LM	1	-0.8155	-3.50	0.4164
		Red	4	-2.7572	-2.93	Red	10	-0.2356	-3.50	1.8330

**Unit Root Tests for First Difference in Albanian Exchange Rate 1992(8) - 1996(4)**

Variable	Sample	Test	Lags	No Trend		Test	Lags	Trend		t-Statistic on Trend Term
				ADF	5%			ADF	5%	
Real ER (Consumer Prices)	1992: 9 to 1996: 4	AIC	5	-2.5538	-2.93	AIC	5	-3.4747	-3.50	2.1926
		BIC	5	-2.5538	-2.93	BIC	5	-3.4747	-3.50	2.1926
	1996: 4	Lj-Bo	0	-15.191	-2.93	Lj-Bo	2	-4.4773	-3.50	1.6578
		LM	0	-15.191	-2.93	LM	0	-15.885	-3.50	2.4773
		Red	10	-0.3464	-2.93	Red	9	-4.9319	-3.50	4.6421

**TABLE 2**  
**Variance Ratio Test Statistics for Albanian Real Exchange Rate**  
**1992: 7) – 1996: 4**

<i>k</i>	Ratio	$Z_1$	Significance	$Z_t$	Significance
2	0.68	-2.147	0.032	-16.795	0.000
3	0.72	-1.252	0.210	-14.694	0.000
4	0.66	-1.161	0.246	-13.924	0.000
5	0.60	-1.204	0.229	-16.667	0.000
6	0.60	-1.050	0.294	-15.001	0.000
7	0.63	-0.896	0.370	-13.824	0.000
8	0.64	-0.812	0.417	-12.900	0.000
9	0.68	-0.634	0.526	-11.264	0.000
10	0.72	-0.488	0.625	- 9.575	0.000
11	0.79	-0.356	0.721	- 6.988	0.000
12	0.92	-0.1400	0.888	- 2.657	0.008

$$(9) \quad \hat{V}_k = \hat{\sigma}_k^2 / \hat{\sigma}_1^2$$

where the numerator is the variance of the real exchange rate at lag length  $k$  and the denominator at lag 1. If the variance ratio is insignificantly different from unity, the null of a random walk cannot be rejected. However, if the variance ratio is significantly less than zero, the time series exhibits mean reversion. Lo and MacKinlay [1988] also define the  $Z_2$  test statistic.

The full set of estimated variance ratio tests, for lags 1 through 8 are reported in Table 2. (Given the relatively short sample period we do not estimate lags longer than 8.) These results tend to reinforce our simple unit root tests in the sense that they portray very strong evidence of mean reversion and, on the basis of the  $Z_2$  statistic, we note that all of these numbers are significantly below unity.

We believe that we have produced strong evidence of mean reversion for the real value of the Albanian lek. Given that the type of tests used have relatively low power, especially when the sample period is relatively small, this would seem to be a strong result and indicates that the real lek has provided a strong center of gravity for relative prices.

## THE NOMINAL EXCHANGE RATE AND EXCESS RELATIVE MONEY SUPPLIES

In estimating equation (5) we use the cointegration methods of Johansen [1995]. Specifically, consider the  $(n \times 1)$  vector of variables  $x_t$  defined by the variables entering (5), and assume that it has a vector autoregressive representation of the form:

$$(10) \quad x_t = \eta + \sum_{i=1}^p \Pi_i x_{t-i} + \varepsilon_t,$$

**TABLE 3**  
**Number of Cointegrating Vectors in the Monetary Model**

Trace	Trace90	Trace95	TraceR95
88.83	49.92	53.12	100.34
44.06	31.88	34.91	65.94
23.00	17.79	19.96	37.70
5.48	7.50	9.24	17.45

where  $\eta$  is a  $(n \times 1)$  vector of deterministic variables, which in our case includes a constant and centered seasonal dummies, and  $\varepsilon$  is a  $(n \times 1)$  vector of white noise disturbances, with mean zero and covariance matrix  $\Xi$ . Expression (10) may be reparameterized into the vector error correction mechanism (VECM) as:

$$(11) \quad \Delta x_t = \eta + \sum_{i=1}^{p-1} \Phi_i \Delta x_{t-i} + \Pi x_{t-1} + \varepsilon_t$$

where  $\Delta$  denotes the first difference operator,  $\Phi_i$  is a  $(n \times n)$  coefficient matrix (equal to  $-\sum_{j=i+1}^p \Pi_j$ ),  $\Pi$  is a  $(n \times n)$  matrix (equal to  $\sum_{i=1}^p \Pi_i - I$  whose rank determines the number of cointegrating vectors. If  $\Pi$  is of either full rank,  $n$ , or zero rank,  $\Pi = 0$ , then either all of the series are stationary or there is no cointegration amongst the elements in the long-run relationship (in these instances it will be appropriate to estimate the model in, respectively, levels or first differences). If, however,  $\Pi$  is of reduced rank,  $r$  (where  $r < n$ ), then there will exist  $(n \times r)$  matrices  $\alpha$  and  $\beta$  such that  $\Pi = \alpha\beta'$  where  $\beta$  is the matrix whose columns are the linearly independent cointegrating vectors. The  $\alpha$  matrix is interpreted as the adjustment matrix, indicating the speed with which the system responds to last period's deviation from the  $r$  equilibrium relationships defined by the  $\beta$ 's. Hence the existence of the VECM model, relative to say a VAR in first differences, depends upon the existence of cointegration.<sup>7</sup>

Table 3 reports the estimated Trace statistics from the estimated VAR model. We note that on the basis of the 90 and 95 percent critical values there are up to three cointegrating vectors. However, given the very small sample size available the final column of Table 3 presents the Reimers small-sample corrected values and on the basis of these we note that none of the Trace statistics are significant, although the first one could be interpreted as marginally significant. Indeed, plotting the constructed vectors was supportive of the first vector being stationary and therefore we conduct our analysis on the basis of this vector. Normalizing the first cointegrating relationship on the exchange rate we have:

$$(12) \quad e_t = 0.338(m_t - m_t^*) - 1.06(y_t - y_t^*) + 0.013(i_t - i_t^*) - 12.29 + \varphi_t.$$

(0.02)
(0.17)
(0.006)
(3.44)

We see that in equation (12) all of the coefficients are correctly signed in terms of the monetary model and all are significantly different from zero on the basis of the reported standard error (noted in parenthesis). Further, the coefficients on the relative

income and interest rate terms are close to their prior values. Indeed, testing the restriction that the coefficient on relative income is minus one cannot be rejected (the chi-squared statistic, with one degree of freedom, has a value of 0.01, with a  $p$ -value of 0.91). This suggests that there are not as yet economies of scale in money holdings in Albania: a one percent rise in income produces an equi-proportionate rise in money holdings. This finding presumably reflects the primitive state of development of the Albanian financial sector. Note that the coefficient on the relative money supply term is less than one, indeed significantly so on the basis of the reported standard error. This therefore suggests a degree of exchange rate undershooting in response to monetary impulses, and supports the view that monetary policy in Albania was restrictive enough to render demand for the lek stable relative to its fundamental determinants. We take this as another positive sign that the transition was going well from 1992 to 1996 because the mean reversion in the exchange rate discussed above predominantly reflected real adjustment rather than adjustment to excess liquidity.

## CONCLUSIONS

We have argued that in a transitional economy the real exchange rate, determined by the relative abundance of traded and nontraded goods, is a key relative price in both microeconomic and macroeconomic equilibrium. Furthermore, we have argued that both the equilibrium real exchange rate and the volatility of the nominal exchange rate are likely to be impacted by the introduction of economic liberalization policies.

In our country application, we have found strong evidence of mean reversion for the real value of the Albanian lek exchange rate for the transitional period from 1992 to 1996. In terms of the theoretical analysis presented in this paper, and given the relatively low correlation between the lek's nominal and real exchange rate, this result suggests that the reform process had been effective for Albania until the beginning of civil unrest from mid-1996. That is, the real exchange rate has provided a "center of gravity" or an attractor for relative prices. Furthermore, our estimate of a monetary model of the nominal lek exchange rate found undershooting, which also supports the view that economic reform was progressing well.

## NOTES

We are grateful to Anthony Clunies-Ross and two anonymous referees for helpful comments on an earlier draft of this paper. We are also grateful to Andrew Davies for efficient research assistance.

1. Some limited reform measures of decentralization were approved in the final years of Communist rule. These included relaxation of the prohibition against direct foreign investment, and legalization of private handicraft and family businesses. Also dating from the 1980s, there was a trend towards trading with convertible currency countries and away from those with inconvertible currencies. Then, in the year before the 1992 election, new reforms led to the privatization of small retail shops and commercial services, large industrial firms were allowed to choose their own output, prices, wages and employment, and, in agriculture, a start was made on distributing small plots of land to the peasants [IMF, 1993]. But the effectiveness of these reforms was badly compromised by the fact that

plans to render state enterprises financially autonomous came to nothing because loans were made to them unconditionally—that is, under a soft budget constraint. In the agricultural sector, efficiency in resource use was hampered by the retention in the state sector of the means of transportation, distribution and marketing [IMF, 1993]. Thus, these limited reforms, quite apart from leaving the economy still highly centralized, left the small private sector compromised by its close association with the system of central planning, social ownership and unclear property rights. Uncertainty concerning the ownership of land seems to have caused a severe fall in food production during 1991.

2. Thus, when  $Q$  increases, the real exchange rate depreciates and international competitiveness increases. Reasons for the choice of the United States are given below.
3. Notice that the absolute slope of EE is flatter than II because a given  $\Delta A$  needs less net export adjustment, through  $\Delta Q$ , for external balance than is the case for internal balance. Thus, suppose that  $\Delta A = 100$  and that the induced  $\Delta X = -25$ . To restore external balance  $Q$  may need to depreciate by, say, 10 percent. But to restore internal balance, the fall in net exports must equal  $-100$ , and this will need a larger depreciation of  $Q$ .
4. It is easy to show that the real exchange rate is the relative price of traded goods. Thus, given  $Q = EP^*/P$ , define  $P = P_T P_{NT}^{1-a}$  (where  $a$  is the share of traded goods in a country's price index), and normalize the foreign price level to unity. Using some elementary algebra gives  $Q = P_T/P_{NT}$ .
5. A-B in fact measures the trade deficit as a proportion of GDP.
6. For a model of money and exchange rate magnification effects see Hallwood and MacDonald [2000, 179-185].
7. The so-called Granger representation theorem [Engle and Granger, 1987] implies that if there exists cointegration among a group of variables there must also exist an error correction representation.

## REFERENCES

- Allen, P. R. and Stein, J. *Fundamental Determinants of Exchange Rates*. Oxford: Oxford University Press, 1995.
- Aoki, M and Kim H. K. Corporate Governance in Transition Economies. *Finance and Development*, September 1995, 20-22.
- Begg, D, Halpern, L. and Wyplosz, C. *Monetary and Exchange Rate Policies, EMU and Eastern Europe*. Forum Report of the Economic Policy Initiative, No. 5, New York: East-West Institute, 1999.
- Campbell, J.Y. and Perron, P. Pitfalls and Opportunities: What Macroeconomists Should Know About Unit Roots., in *NBER Economic Manual* edited by O.J Blanchard and S. Fischer. Cambridge: NBER, 1991.
- Clunies-Ross, A. and Sudar, P. *Albania's Economy in Transition and Turmoil, 1990-1997*. Aldershot: Ashgate, 1998.
- Cochrane, J. H. How Big is the Random Walk in GNP? *Journal of Political Economy*, 1988, 96, 893-920.
- Corden, W. M. and Neary, J. P. Booming Sector and Deindustrialization in a Small Open Economy. *Economic Journal*, December 1982, 825-48.
- Dickey, D. and Fuller, W. A. Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of American Statistical Association*, 1979, 74, 427-31.
- Dornbusch, R. Devaluation, Money and Non-traded Goods. *American Economic Review*, December 1973, 875-80.
- Engle, R. and Granger, C. W. J. Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica*, 1987, 55, 251-276.
- Fuller, W. A. *Introduction to Statistical Time Series*, New York: Wiley, 1976.
- Hallwood, P. and MacDonald, R. *International Money and Finance*, Oxford: Blackwells, 2000.
- Halpern, L. and Wyplosz, C. Equilibrium Exchange Rates in Transition Economies. *IMF Staff Papers*, December 1997, 430-61.
- IMF. Albania's Reform Efforts Lead to Economic Recovery. *IMF Survey*, 16 May 1994, 157-59.
- \_\_\_\_\_. Albania: ESAF, *IMF Survey*, 17 October 1994, 329-30.
- \_\_\_\_\_. IMF Study Examines Albania's Transition From Isolation Toward Economic Reform. *IMF Survey*, 8 March 1993, 77-80.



- Johansen, S.** *Likelihood-based Inference in Cointegration Vector Autoregressive Models*. Oxford: Oxford University Press, 1995.
- Krajnyak, K. and Zettelmayer, J.** Competitiveness in Transition Economies: What Scope for Real Appreciation? *IMF Staff Papers*, June 1998, 309-62.
- Lo, A. and MacKinlay, C.** Stock Prices Do Not Follow Random Walks: Evidence from a Simple Specification Test. *The Review of Financial Studies*, 1988, 1, 41-66.
- MacDonald, R.** Long-run Exchange Rate Modeling: A Survey of the Recent Evidence. *IMF Staff Papers*, September 1995, 437-89.
- Sundakov, A., Ossowski, R., and Lane, T. D.** Shortages Under Free Prices: The Case of Ukraine in 1992. *IMF Staff Papers*, September 1994, 411-24.
- Williamson, J.** *Estimating Equilibrium Exchange Rates*. Washington DC: Institute for International Economics, 1994.